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Serologic study of *Rickettsia typhi* infection among the human population of southern Spain

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Endemic or murine typhus (MT) and several spotted fever rickettsioses (SFR) are endemic diseases in the Iberian peninsula. Murine typhus, an acute febrile illness caused by *Rickettsia typhi*, has been documented in diverse geographic areas, including the Mediterranean, Africa, Southeast Asia, and the United States [1]. In this work, we evaluate the prevalence of past infection due to *R. typhi* in Jaén province (Andalusia, Spain).

Serum samples from 734 individuals (285 men, 449 women) from the North Sanitary District of Jaén province were tested for the presence of IgG antibodies against rickettsiae by indirect immunofluorescence assay (IFA) using commercially available antigen for *R. typhi* (Focus Technologies, Cypress, CA, USA) and Spotted Fever Group rickettsiae (*R. rickettsii*, Focus Technologies, *R. conorii*, bioMérieux, and *R. slovaca*, antigen slides kindly donated by Dr Fátima Bacellar, CEDVI, Lisbon). Two-fold dilutions of human sera were applied to the antigens. The slides were incubated in a humidified chamber at 37°C for 30 min. After washes in PBS-Tween and water to remove unbound immunoglobulins, binding sera was detected by using fluorescein isothiocyanate-labelled goat anti-human IgG (bioMérieux, Marcy l'Etoile, France). Slides were incubated and washed as described above and were examined with a fluorescence microscope at 400×. Endpoint titres were obtained by serial dilution on positive specimens, with titres 1/64 or higher considered indicative of past infection with *R. typhi* when the titres against SFG *Rickettsia* were at least two dilutions lower.

Seroprevalence was determined by age and by type of residential community (Fig. 1). Values were described as means and standard deviations.

Prevalence of past infection with *R. typhi* was 18.0%, corresponding with 96, 24, 9 and 3 positive samples with titre 1/64, 1/128, 1/256 and 1/512, respectively. The serum antibody titre of *R. conorii* was identical to that of *R. typhi* 10 times at 1/64 dilution, and only once was greater than two dilutions (1/512 in front of 1/64). We did not find significant titres against *R. slovaca*.

Our study confirms the widespread distribution of *R. typhi* in Jaén province, as reflected by moderate prevalence of past infection due to these agents in a representative sample of the general human population. The prevalence value reached is similar to values obtained (21.4%) in rural areas of the Catalonia region, but it is higher than the values obtained in similar studies in urban areas of Seville or Catalonia (3.8 and 7.6%, respectively) [2,3]. We detected elevated antibody titres against *R. typhi* in asymptomatic carriers among healthy populations of the studied area, even considering that there could be cross-reactions with other typhus group rickettsiae. Our results suggest that most of the infections by this *Rickettsia* are subclinical or misdiagnosed. Murine typhus is mainly transmitted by the fleas of rodents, and is associated with cities and ports where urban rats (*Rattus rattus* and *Rattus norvegicus*) are abundant. Contrary to the classic rat–flea–rat cycle, in certain areas the most important reservoirs of infection, as for *R. felis* in this area, may be cats, and the cat flea, *Ctenocephalides felis*, has been identified as the principal vector [4,5].

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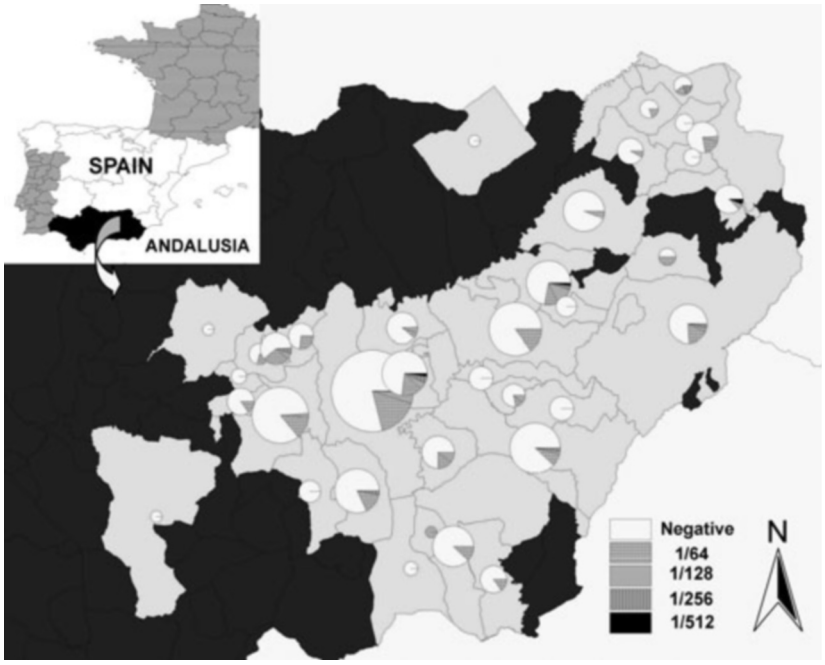

Fig. 1. Frequency reached for each serum titre against *R. typhi* in municipalities studied from the North Health District of Jaen province (Andalusia, Spain).

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